Priscu, J.C. 2002. Commentary: Subglacial Lakes have changed out view of Antarctica. Antarctic Science. 14:291.

SUBGLACIAL LAKES HAVE CHANGED OUR VIEW OF ANTARCTICA

Captain Scott thought the inland icesheet not only inhospitable but lifeless, a concept that has persisted for much of the past century. Recent discoveries of life under the 3.5km thick ice sheet covering Antarctica have, however, radically changed this view of the interior of the Antarctic continent. They also provide considerable challenges to the way we conduct science in an atmosphere of increasingly stringent environmental concerns.

Life within the interior ice sheet was only recently recognized with the reports of bacteria in the accretion ice above Lake Vostok, an enormous lake (~14,000 km^2, >1000m deep) beneath Vostok Station. From estimates of bacterial numbers in the accretion ice, and using ice-water partitioning coefficients, it was estimated that Lake Vostok itself could contain up to 10^6 bacterial cells ml^{-1}, similar to that in the open ocean. Recent Russian data on DNA in accretion ice have indicated that thermophyllic bacteria may exist within the lake. Evidence for this is supported by the recent interpretation by French scientists of He^3/He^4 data from accretion ice which now implies that there may be geothermal plumes entering the bottom of the lake. If this emerging picture is correct, Lake Vostok could harbor a unique assemblage of organisms fueled by chemical energy.

The recent evidence for the presence of microbes in Lake Vostok has changed our view of the extent of Earth's biosphere. Airborne radar surveys have shown that at least 100 more subglacial lakes exist beneath the ice sheet and these may contain life in what was once thought to be an inhospitable environment. These lakes, though not nearly as large as Vostok, are still substantial with at least one exceeding 800 km^2 in surface area. The high density of lakes near Dome C implies that a hydrologically interconnected lake district may exist in this region of Antarctica.

How should we approach research in these subglacial lakes? A formal interdisciplinary Subglacial Antarctic Lake Group of Specialists (SALEGOS) was organized by SCAR in July 2000 (http://salegos-scar.montana.edu/). SALEGOS outlined a detailed plan which calls for the establishment of a network of lake observatories within the next 3-6 years. These observatories will consist of a string of instruments lowered into each lake that collect data continuously and send it in real time to the surface. Such information can be used to plan the next stage of lake exploration outlined by the Group, which includes actual return of water samples to the surface within 6-9 years. The final stage involves the return of deep sediment cores that can be used to reconstruct paleoclimate and geological records for Antarctica. The Group emphasizes that the plan, while phased-in, is not a linear progression of steps, one leading to the next, but must be a complex interplay of parallel developments that converge at critical milestones to achieve the programmed goals and objectives. All these proposed activities must, of course, meet environmental concerns, particularly those relating to contamination of these unique ecosystems. These concerns will greatly increase the cost of the lake entry and sample return, and are the focus for considerable debate in SCAR and at the Antarctic Treaty .

All those involved in this research need to understand that that environmental stewardship must take precedence over scientific endeavours. To do otherwise would be foolhardy. We can expect subglacial lakes to be at the forefront of the Antarctic tradition of melding interdisciplinary and international science in exploring one of the last unexplored frontiers on our planet.

John Priscu
Montana State University at Bozeman